

**Claims:**

1. A method of creating an image, said image to be formed by compositing at least a plurality of graphical objects, each said object having a predetermined outline, said method comprising the steps of:

5 determining an expression for each of a plurality of active regions, each said active region being defined by at least one region outline following at least one of said predetermined outlines or parts thereof;

determining expressions representing each of a plurality of effective regions depending on at least one characteristic of at least one active region, wherein each said effective region has a corresponding compositing operation; and

10 applying said corresponding compositing operations substantially to said effective regions to create said image.

2. A method according to claim 1, wherein a further region is determined on the basis that a particular region corresponds to a primitive expression.

3. A method according to claim 1, wherein an effective region is determined on the basis that a particular active region corresponds to a primitive expression.

20 4. A method according to claim 2, wherein said further region is an effective region.

5. A method according to claim 4, wherein said effective region is equal to the intersection of the clip and active regions of said particular corresponding compositing expression.

6. A method according to claim 1, wherein said image is at least in part a pixel based image.

30 7. A method according to claim 1, wherein a wholly opaque object in a particular region acts to eliminate one or more operations contributing to at least one other object constituting said particular region, wherein said at least one other object is obscured by said wholly opaque object in a space in which said outlines are defined.

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8. A method of creating an image, said image to be formed by compositing at least a plurality of graphical objects, each said object having a predetermined outline, said method comprising the steps of:

5 dividing a space in which said outlines are defined into a plurality of regions, each said region being defined by at least one region outline following at least one of said predetermined outlines or parts thereof;

determining a plurality of further regions depending on at least one characteristic of at least one region, wherein each said further region has a corresponding compositing  
10 operation;

mapping said further regions and corresponding compositing operations into a compositing table, comprising a plurality of levels, wherein each said level of said compositing table represents at least one operation for rendering an object or parts thereof or represents an outline for clipping at least one other level; and

15 compositing said image using said compositing table.

9. A method according to claim 8, wherein a further region is determined on the basis that a particular region corresponds to a primitive expression.

20 10. A method according to claim 8, wherein an effective region is determined on the basis that a particular active region corresponds to a primitive expression.

11. A method according to claim 10, wherein said further region is an effective region.

25 12. A method according to claim 11, wherein said effective region is equal to the intersection of the further and active regions of said particular corresponding compositing expression.

30 13. A method according to claim 11, wherein a level comprising a push operation is added to said compositing table.

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14. A method according to claim 11, wherein a corresponding compositing expression of said further region is complex.

5 15. A method according to claim 14, wherein a level comprising a clip operation is added to said compositing table.

16. A method according to claim 8, wherein a further region is determined on the basis that said corresponding compositing operation has a complex left operand.

10 17. A method according to claim 16, wherein a level comprising a pop operation is added to said compositing table.

15 18. A method according to claim 17, wherein said pop operation will remove any unused pixel being outside a further region representing said complex left operand, during compositing of said complex left operand.

19. A method according to claim 18, wherein said further region is the active region of said complex left operand.

20 20. A method according to claim 18, wherein said further region is transformed to a still further region by said pop operation.

21. A method according to claim 20, wherein said still further region is the effective region of said complex left operand.

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41. A method according to claim 21, wherein said still further region corresponds to a complex expression.

30 23. A method according to claim 22, wherein a level comprising a clip operation is added to said compositing table.

24. A method according to claim 8, wherein a further region is determined on the basis that said corresponding compositing operation has a primitive left operand.

25. A method according to claim 9, wherein a level comprising an operation and a data fill value of a particular object constituting said further region, is added to said compositing table.

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26. A method according to claim 24, wherein said further region corresponds to a complex expression.

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27. A method according to claim 26, wherein a level comprising a clip operation is added to said compositing table.

28. A method according to claim 24, wherein a level comprising a push operation is added to said compositing table.

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29. A method according to claim 8, wherein said compositing table is optimised in regard to the number of pixel operations required to render said image.

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30. A method according to claim 8, wherein a corresponding compositing expression is a hierarchically structured representation of a particular region represented by said corresponding compositing expression.

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31. A method according to claim 30, wherein said mapping comprises modifying a manner in which said corresponding compositing expression is evaluated without modifying said hierarchically structured representation.

32. A method according to claim 8, wherein said image is at least in part a pixel based image.

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33. A method according to claim 8, wherein a wholly opaque object in a particular region acts to eliminate one or more operations contributing to at least one other object constituting said particular region, wherein said at least one other object is obscured by said wholly opaque object in a space in which said outlines are defined.

mapping each said effective region and corresponding operation into a compositing table, comprising a plurality of levels, wherein each said level of said

compositing table represents at least one operation for rendering an object or part thereof constituting at least one of said effective regions; and

evaluating said hierarchially structured compositing expression using said compositing table.

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38. A method of calulating effective regions for a plurality of graphical objects, each said object having a predetermined outline, said method comprising the steps of:

dividing a space in which said outlines are defined into a plurality of active regions, each said active region being defined by at least one region outline following at least one of said predetermined outlines or parts thereof, each said active region having at least one corresponding Boolean expression; and

calculating said effective regions depending on at least one charateristic of at least one corresponding Boolean expression, wherein each said effective region has a corresponding Boolean operation.

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39. A method according to claim 38, wherein said corresponding Boolean operation is a stack operation.

40. A method according to claim 38, wherein said corresponding Boolean expression is primitive.

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41. A method according to claim 38, wherein said corresponding Boolean operation has a primitive left operand.

42. A method according to claim 38, wherein said corresponding Boolean operation has a complex left operand.

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43. A method of creating an image, said image to be formed by compositing at least a plurality of graphical objects, each said object having a predetermined outline, said method comprising the steps of:

dividing a space in which said outlines are defined into a plurality of active regions, each said active region being defined by at least one region outline following at least one of said predetermined outlines or parts thereof;

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62. A method according to claim 61, wherein a level comprising a clip operation is added to said compositing table.

5 63. A method according to claims 59, wherein a level comprising a push operation is added to said compositing table.

64. A method according to claim 43, wherein said compositing table is optimised in regard to the number of pixel operations required to render said image.

10 65. A method according to claim 43, wherein a corresponding compositing expression is a hierarchically structured representation of a particular region represented by said corresponding compositing expression.

15 66. A method according to claim 65, wherein said mapping comprises modifying a manner in which said corresponding compositing expression is evaluated without modifying said hierarchically structured representation.

20 67. A method according to claim 43, wherein said image is at least in part a pixel based image.

25 68. A method according to claim 43, wherein a wholly opaque object in a particular region acts to eliminate one or more operations contributing to at least one other object constituting said particular region, wherein said at least one other object is obscured by said wholly opaque object in a space in which said outlines are defined.

69. An apparatus for creating an image, said image to be formed by compositing at least a plurality of graphical objects, each said object having a predetermined outline, said apparatus comprising:

30 means for determining an expression for each of a plurality of active regions, each said active region being defined by at least one region outline following at least one of said predetermined outlines or parts thereof;

means for determining expressions representing each of a plurality of effective regions depending on at least one characteristic of at least one active region, wherein each said effective region has a corresponding compositing operation; and

means for applying said corresponding compositing operations substantially to  
5 said effective regions to create said image.

70. An apparatus according to claim 69, wherein a further region is determined on the basis that a particular region corresponds to a primitive expression.

10 71. An apparatus according to claim 69, wherein an effective region is determined on the basis that a particular active region corresponds to a primitive expression.

72. An apparatus according to claim 70, wherein said further region is an effective region.

15 73. An apparatus according to claim 72, wherein said effective region is equal to the intersection of the clip and active regions of said particular corresponding compositing expression.

20 74. An apparatus according to claim 70, wherein a level comprising a push operation is added to said compositing table.

75. An apparatus according to claim 70, wherein a corresponding compositing expression of said further region is complex.

25 76. An apparatus according to claim 75, wherein a level comprising a clip operation is added to said compositing table.

77. An apparatus according to claim 70, wherein a further region is determined on  
30 the basis that said corresponding compositing operation has a complex left operand.

78. An apparatus according to claim 70, wherein a level comprising a pop operation is added to said compositing table.

79. An apparatus according to claim 78, wherein said pop operation will remove any unused pixel being outside a further region representing said complex left operand, during compositing of said complex left operand.

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80. An apparatus according to claim 79, wherein said further region is the active region of said complex left operand.

81. An apparatus according to claim 79, wherein said further region is transformed to a still further region by said pop operation.

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82. An apparatus according to claim 81, wherein said still further region is the effective region of said complex left operand.

83. An apparatus according to claim 82, wherein said still further region corresponds to a complex expression.

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84. An apparatus according to claim 82, wherein a level comprising a clip operation is added to said compositing table.

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85. An apparatus according to claim 70, wherein a further region is determined on the basis that said corresponding compositing operation has a primitive left operand.

86. An apparatus according to claim 70, wherein a level comprising an operation and a data fill value of a particular object constituting said further region, is added to said compositing table.

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87. An apparatus according 85, wherein said further region corresponds to a complex expression.

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88. An apparatus according to claim 87, wherein a level comprising a clip operation is added to said compositing table.

90. An apparatus according to claim 70, wherein said compositing table is optimised  
5 in regard to the number of pixel operations required to render said image.

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15 93. An apparatus according to claim 70, wherein said image is at least in part a pixel based image.

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mapping means for mapping said further regions and corresponding compositing operations into a compositing table, comprising a plurality of levels, wherein each said

level of said compositing table represents at least one operation for rendering an object or parts thereof or represents an outline for clipping at least one other level; and  
compositing means for compositing said image using said compositing table.

- 5 96. An apparatus according to claim 95, wherein a further region is determined on the basis that a particular region corresponds to a primitive expression.
97. An apparatus according to claim 95, wherein an effective region is determined on the basis that a particular active region corresponds to a primitive expression.
- 10 98. An apparatus according to claim 95, wherein said further region is an effective region.
99. An apparatus according to claim 98, wherein said effective region is equal to the intersection of the clip and active regions of said particular corresponding compositing expression.
- 15 100. An apparatus according to claim 98, wherein a level comprising a push operation is added to said compositing table.
- 20 101. An apparatus according to claim 95, wherein a corresponding compositing expression of said further region is complex.
102. An apparatus according to claim 101 wherein a level comprising a clip operation is added to said compositing table.
- 25 103. An apparatus according to claim 95 wherein a further region is determined on the basis that said corresponding compositing operation has a complex left operand.
- 30 104. An apparatus according to claim 103, wherein a level comprising a pop operation is added to said compositing table.

105. An apparatus according to claim 104, wherein said pop operation will remove any unused pixel being outside a further region representing said complex left operand, during compositing of said complex left operand.

5 106. An apparatus according to claim 105, wherein said further region is the active region of said complex left operand.

107. An apparatus according to claim 105, wherein said further region is transformed to a still further region by said pop operation.

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108. An apparatus according to claim 107, wherein said still further region is the effective region of said complex left operand.

109. An apparatus according to claim 107, wherein said still further region  
15 corresponds to a complex expression.

110. An apparatus according to claim 109, wherein a level comprising a clip operation is added to said compositing table.

20 111. An apparatus according to claim 95, wherein a further region is determined on the basis that said corresponding compositing operation has a primitive left operand.

112. An apparatus according to claim 96, wherein a level comprising an operation and a data fill value of a particular object constituting said further region, is added to said  
25 compositing table.

113. An apparatus according to claim 111, wherein said further region corresponds to a complex expression.

30 114. An apparatus according to claim 113, wherein a level comprising a clip operation is added to said compositing table.

115. An apparatus according to claim 111, wherein a level comprising a push operation is added to said compositing table.

116. An apparatus according to claim 95, wherein said compositing table is optimised in regard to the number of pixel operations required to render said image.

117. An apparatus according to claim 95, wherein a corresponding compositing expression is a hierarchically structured representation of a particular region represented by said corresponding compositing expression.

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118. An apparatus according to claim 117, wherein said mapping comprises modifying a manner in which said corresponding compositing expression is evaluated without modifying said hierarchically structured representation.

119. An apparatus according to claim 95, wherein said image is at least in part a pixel based image.

120. An apparatus according to claim 96, wherein a wholly opaque object in a particular region acts to eliminate one or more operations contributing to at least one other object constituting said particular region, wherein said at least one other object is obscured by said wholly opaque object in a space in which said outlines are defined.

121. A computer readable medium for storing a program for apparatus which processes graphical objects intended to form a raster pixel image, said processing comprising a method of creating an image, said image to be formed by compositing at least a plurality of graphical objects, each said object having a predetermined outline, said method program comprising:

code for determining an expression for each of a plurality of active regions, each said active region being defined by at least one region outline following at least one of said predetermined outlines or parts thereof;

code for determining expressions representing each of a plurality of effective regions depending on at least one characteristic of at least one active region, wherein each said effective region has a corresponding compositing operation; and

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operand of said node and a further region associated with said node, wherein each said effective region has a corresponding rendering operation; and

applying said corresponding rendering operations substantially to said effective regions to create said image.

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124. The method according to claim 123, said method further including the steps of:  
mapping said effective regions and said rendering operations into a compositing table comprising a plurality of levels, wherein each said level represents at least one rendering operation for rendering an object or parts thereof or represents an outline for clipping at least one other level; and  
compositing said image using said compositing table.

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125. The method according to claim 123, wherein said rendering operations include compositing and stack operations.

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126. A computer readable medium for storing a program for apparatus which processes graphical objects intended to form a raster pixel image, said processing comprising a method of creating an image, said image to be formed by compositing at least a plurality of graphical objects according to a hierarchical structure representing a compositing expression for said image, said hierarchical structure including a plurality of nodes, said program comprising

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code for determining an active region for each sub-expression of said compositing expression, said active region representing a smallest region in which a result of said sub-expression is classified as non-transparent;

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code for determining a further region for each sub-expression of said compositing expression, said further region representing an intersection of all active regions associated with further sub-expressions containing said sub-expression;

code for determining an effective region for each of said nodes, said effective region being dependent on at least one characteristic of an active region associated with an operand of said node and a further region associated with said node, wherein each of said effective regions has a corresponding rendering operation; and

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code for applying said corresponding rendering operations substantially to said effective regions to create said image.

code for mapping said effective regions and said rendering operations into a  
5 compositing table comprising a plurality of levels, wherein each said level represents at  
least one rendering operation for rendering an object or parts thereof or represents an  
outline for clipping at least one other level; and

10 128. The computer readable medium according to claim 126, wherein said rendering operations include compositing and stack operations.